

FOREWORD

First and foremost, the author would love to thank God for only by His blessings and guidance the author is able to finish the thesis entitled “GRAPHICAL MULTICONFIGURATION OF A SMART MINING FOG SIMULATION USING THE IFOGSIM TOOLKIT”, properly in accordance with the planned time. This thesis would never be finished without the support and contribution from various parties involved. Therefore, the author would like to express his gratitude towards these parties, which includes:

- 1) Mr. Dr.Eng., Pujianto Yugopuspito, M.Sc., as Dean of the Computer Science Faculty, and as the author’s Thesis Advisor in providing many key suggestions for the thesis and supporting the author in any other ways.
- 2) Mrs. Irene A. Lazarusli, S.Kom., M.T. as Department Chair of Informatics, and as the authors “Guardian Angel” in providing countless beacons of hope and support throughout the author’s toughest times during his university life.
- 3) Mr. Frans Panduwinata, S.Kom., M.T. as one of the best IT lecturers I know, that would stop at nothing to help see his students through tough times.
- 4) Mr. Dr. David Habsara Hareva, S.Si., MHS as the author’s Academic Supervisor throughout the author’s undergraduate life.
- 5) The author’s family who has provided the author with much support and loads of prayers while working on this final assignment.
- 6) The author’s friends within and outside of UPH in providing emotional support while working on this final assignment.

7) All other parties that the author could not mention one by one, which has also participated in helping, guiding, and supporting the author throughout his life.

Finally, the author wishes that this final thesis can be beneficial to all parties who reads it, be used as other research materials, and could also be used for further development, resulting in better benefits.

Tangerang, 25th September 2020

Nicholas Chen

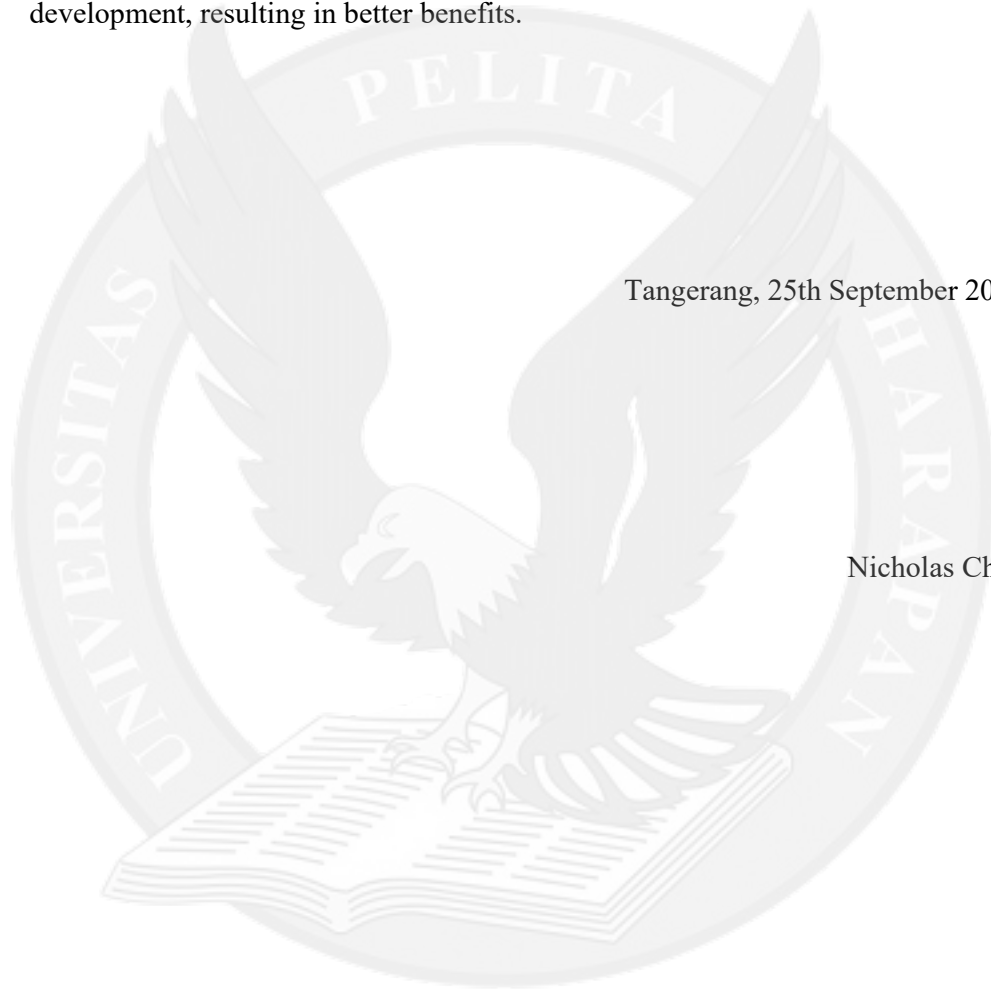


TABLE OF CONTENTS

ABSTRACT	ii
ABSTRAK.....	vi
FOREWORD.....	vii
TABLE OF CONTENTS	ix
TABLE OF FIGURES.....	xi
TABLE OF TABLES	xiii
CHAPTER I INTRODUCTION.....	1
1.1 Background	1
1.2 Problem Formulation	6
1.3 Scope Limitation	6
1.4 Purposes	7
1.5 Methodology	8
1.6 Writing Systematic.....	9
CHAPTER II LITERATURE REVIEW.....	11
2.1 Mining.....	11
2.2 Smart Mining and Look-Ahead Technologies.....	12
2.3 JavaFX	13
2.4 Cloud Computing.....	14
2.5 Fog Computing	14
2.6 Cloud Computing vs. Fog Computing	16
2.7 iFogSim Definition	17
2.7.1 iFogSim Architecture.....	17
2.7.2 iFogSim Design.....	21
2.7.3.1 Physical Components	21
2.7.3.2 Logical Components	22
2.7.3.3 Management Components.....	22
2.7.3 Module Placement Strategies.....	24
CHAPTER III SYSTEM DESIGN.....	25
3.1 Smart Mining Simulation Plan.....	25
3.2 Conducting Adequate Research	26
3.3 Determining the Fog Hierarchy/Topology.....	27

3.3.1	Determining the Fog Devices and their Specifications.....	28
3.3.2	Determining the Performance Measurement Values	29
3.4	Creation of a Wireframe UI	30
3.5	Creation of the JavaFX Controller Classes	31
3.5.1	Save File Options	34
3.6	Naming the Text Files.....	35
3.6.1	Visualizing the Text Files into a LineChart	36
3.6.2	Planning the Text File Content	38
3.7	Smart Mining Fog Simulation Lifecycle Plan	38
CHAPTER IV RESULTS AND ANALYSIS		40
4.1	Source Code Setup	40
4.1.1	Errors in the Source Code	40
4.1.2	Solution to the Source Code Errors.....	43
4.2	Modelling the GUI with Scenebuilder	46
4.3	Event Listeners in the <i>GraphicsController</i> class	47
4.4	Getters and Setters in <i>SmartMiningMain</i>	48
4.5	The <i>startSimulatorOnClick</i> method	49
4.6	Visualizing the Bar Charts	50
4.6.1	The <i>ObservableValue</i> feature.....	51
4.7	Completed Multiconfiguration GUI.....	52
4.8	Implementing the Save File feature	53
4.8.1	LineChart Main Execution classes.....	56
4.8.2	Modelling the LineChart GUI with Scenebuilder	57
4.8.3	Actualizing the Text File Content	58
4.8.4	Text File Reading and Writing into the LineCharts.....	59
4.8.5	LineChart GUI Results.....	64
4.9	Configuration Comparison Pre-Implementation.....	66
4.9.1	Configuration Comparison Post-Implementation	69
CHAPTER V CONCLUSION AND SUGGESTIONS		86
5.1	Conclusion	86
5.2	Suggestions	87
REFERENCES		89

TABLE OF FIGURES

Figure 2.1 Distributed data processing in a Fog Computing environment.	15
Figure 2.2 iFogSim Simulation Architecture.....	19
Figure 2.3 Sense-Process-Actuate DDF Model	20
Figure 2.4 High-level overview of the interactions among the iFogSim components.	23
Figure 3.1 Smart Mining Simulation Plan	25
Figure 3.2 Improved Master-Worker Application Model lifecycle of the Smart Mining environment	27
Figure 3.3 Smart Mining Visual Topology.....	28
Figure 3.4 Wireframe model of the intended GUI.....	32
Figure 3.5 iFogSim Class Relationship Model	33
Figure 3.6 Sequence Diagram of obtaining the console outputs and getting them into <i>GraphicsController</i>	34
Figure 3.7 Wireframe model of LineChart GUI	37
Figure 3.8 Wireframe model of LineChart GUI	39
Figure 4.1 Smart Mining Fog Simulation Source Code Output.....	42
Figure 4.2 <i>ModuleMapping</i> , before improvement	43
Figure 4.3 <i>ModuleMapping</i> , after improvement.....	44
Figure 4.4 Application Method – AppEdges and TupleMapping, before improvement	44
Figure 4.5 Application Method – AppEdges and TupleMapping after improvement	45
Figure 4.6 Application Method – AppLoop, before improvement.....	45
8Figure 4.7 Application Method – AppLoop, after improvement.....	45
Figure 4.8 Snippets of the new Smart Mining Fog Simulation output	46
Figure 4.9 Preview of the Smart Mining Multi-configuration GUI modeled through Scenebuilder	47

Figure 4.10 Code example of the GUI detecting changes in the user configuration panel and changing the view respective to the user choice	48
Figure 4.11 Snippet of Setter Methods in <i>SmartMiningMain</i>	48
Figure 4.12 Snippet of concurrency algorithm used in <i>GraphicsController</i>	49
Figure 4.13 Save buttons to be shown on the configuration panel of the GUI, post-simulation.....	50
Figure 4.14 Snippet of code portion responsible in updating the bar charts.....	50
Figure 4.15 ObservableValue listener feature to display bar chart values on top of the bar charts, and a rounding method to round the decimals to conserve canvas space in the GUI.....	52
Figure 4.16 Snippet of the completed, post-simulation multi-configuration GUI.....	53
Figure 4.17 Snippet of Save-Toward-Master-Node metric.....	54
Figure 4.18 Snippet of Save-Toward-Sensor-Metric	55
Figure 4.19 <i>Application Loop Delay</i> Main Execution Class	56
Figure 4.20 <i>Network Usage</i> Main Execution Class	57
Figure 4.21 Line Chart GUI completed design for Application Loop Delay	58
Figure 4.22 LineChart completed design for Network Usage	58
Figure 4.23 Content of <i>app-delay.txt</i> and <i>network-usage.txt</i> files	59
Figure 4.24 Reading the text file and adding the strings into a List	60
Figure 4.25 Reading the text file and adding the strings into a List (Network Usage)	61
Figure 4.26 Snippet of code design of App Loop Delay Line Chart output, with x-coordinate as Master Node amount	62
Figure 4.27 Snippet of code design of Network Usage Line Chart output, with x-coordinate as Master Node amount	64
Figure 4.28 Top-Bottom results of completed Application Loop Delay and Network Usage LineChart GUIs.....	65

TABLE OF TABLES

Table 2.1 Cloud Computing vs. Fog Computing	16
Table 3.1 Smart Mining Old and New Fog Hierarchy Comparison	28
Table 3.2 Fog Device Specifications that will be used	29
Table 3.3 Save Text File Naming	36
Table 3.4 Creation of classes and FXML files for the LineChart visualization feature.....	37
Table 4.1 Logical Errors found in the Source Code	41
Table 4.2 Application Loop Delay and Network Usage	55
Table 4.3 Master Node Variance w/ Edgeward Module Placement	67
Table 4.4 Master node Variance w/ Cloudward Module Placement	67
Table 4.5 Sensor Variance with Edgeward Module Placement.....	67
Table 4.6 More Specific Sensor Variance with Edgeward Module Placement	68
Table 4.7 Network Usage and Cloud Network Usage	69
Table 4.8 Network Usage and Cloud Network Usage	70
Table 4.9 Energy Consumption	71
Table 4.10 Energy Consumption	72
Table 4.11 Application Loop Delay.....	73
Table 4.12 Application Loop Delay.....	74
Table 4.13 Tuple CPU Execution Delay.....	75
Table 4.14 Tuple CPU Execution Delay.....	76
Table 4.15 Network Usage and Cloud Network Usage	77
Table 4.16 Energy Consumption	78
Table 4.17 Application Loop Delay.....	79
Table 4.18 Tuple CPU Execution Delay.....	81
Table 4.19 Application Loop Delay.....	83
Table 4.20 Tuple CPU Execution Delay.....	84